

FACSIMILE TRANSMISSION

Name: Examiner J. Mitchell

TO: Company: PTO

Fax No.: 703-308-7382 Phone No.: 703-308-4083

Name: Thomas E. Lees, Esq.

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Patents, Trademarks and Related Matters
Killworth, Gottman, Hagan & Schaeff, LLP

One Dayton Centre
One South Main Street, Suite 500
Dayton, Ohio 45402-2023

937.223.2050
Fax | 937.223.0724
E-mail | hghs@hghs.com

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Applicants : David R. Hembree et al.
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29. (Amended) An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device arranged to press said semiconductor against said interconnect structure to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including an elastic member comprised of a first elastomeric material, and a conductive member.

30. The apparatus of claim 29, wherein said conductive member comprises a plurality of conductive particles.

31. The apparatus of claim 29, wherein said plurality of conductive particles are interspersed within said elastomeric member.

36. The apparatus of claim 29, wherein said conductive member is comprised of conductive material selected from the group consisting of gold, aluminum, nickel, silver, stainless steel, and alloys thereof.

37. The apparatus of claim 29, wherein said semiconductor is electrically biased through said spring element.

38. The apparatus of claim 29, wherein said semiconductor comprises a semiconductor die.

39. The apparatus of claim 29, wherein said semiconductor comprises a semiconductor die formed within a semiconductor package.

40. The apparatus of claim 39, wherein said semiconductor package comprises a package selected from the group consisting of a chip-scale package, a ball grid array, a chip-on-board, a direct chip attach, and a flip-chip.

44. (Amended) An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device arranged to press said semiconductor against said interconnect structure to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including a conductive member and a first elastic member comprised of a first elastomeric material having first force transfer characteristics, said first elastic member having a plurality of holes formed therein such that said spring element has overall force transfer characteristics different from said first force transfer characteristics.

45. (Amended) The apparatus of claim 44, wherein said spring element further comprises an elastic member comprised of a second elastomeric material having second force transfer characteristics, said second elastic member positioned in at least one of said plurality of holes formed in said first elastic member such that said overall force transfer characteristics are different from said first and second force transfer characteristics.

46. The apparatus of claim 44, wherein said spring element further comprises a plurality of second elastic members positioned in a plurality of said plurality of holes in said first elastic member.

47. The apparatus of claim 44, wherein said conductive member comprises a plurality of conductive particles.

50. (Amended) An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device arranged to press said semiconductor against said interconnect structure to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including an elastic member comprised of a conductive member and an elastomeric material having first force transfer characteristics, said first elastic member having at least one hole formed therein such that said spring element has overall force transfer characteristics different from said first force transfer characteristics, said elastic member being shaped so as to engage an outer edge of said semiconductor such that a force applied by said attachment device as said semiconductor is pressed by said attachment device against said interconnect structure is substantially uniform around said semiconductor.

51. The apparatus of claim 50, wherein said conductive member comprises a plurality of conductive particles.

54. (Amended) An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

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an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including a first conductive member, a first elastic member and a second elastic member, said first elastic member comprising a first elastomeric material having first force transfer characteristics and said second elastic member comprising a second elastomeric material having second force transfer characteristics, said second elastic member being positioned within said first elastic member such that said spring element has overall force transfer characteristics different from said first and second force transfer characteristics.

55. The apparatus of claim 54, further comprising a plurality of said second elastic members formed within said first elastic member.

56. The apparatus of claim 54, wherein said conductive member comprises a plurality of conductive particles.

63. (Amended) An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

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an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device arranged to press said semiconductor against said interconnect structure to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including a conductive member and an elastic member comprised of an elastomeric material having first force transfer characteristics, said elastic member having at least one cavity formed therein such that said spring

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element has overall force transfer characteristics different from said first transfer characteristics of said elastomeric material.

64. The apparatus of claim 63, wherein said elastic member has a plurality of cavities formed therein.

65. The apparatus of claim 63, wherein said conductive member comprises a plurality of conductive particles.

68. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including a conductive member and an elastic member having a variable spring constant.

69. The apparatus of claim 68, wherein said conductive member comprises a plurality of conductive particles.

73. The apparatus of claim 29, wherein said conductive member comprises carbon.

REMARKS

Claims 29-31, 36-40, 44-47, 50, 51, 54-56, 63-65, 68, 69, and 73 are pending in the present application. Claims 29, 44, 45, 50, 54, and 63 have been amended herein.

A semiconductor may be tested or burned in by placing the semiconductor on an interconnect structure that includes traces that couple the semiconductor to an electrical circuit. An attachment device comprises a spring element configured so that it exhibits the desired pressure absorption and force transfer characteristics to adequately press the semiconductor against the interconnect structure (Page 13, lines 6-12). The spring element ensures that enough pressure is applied to the semiconductor to enable satisfactory electrical performance between the semiconductor and the interconnect structure, but not so much pressure so as to damage the apparatus (Page 13, lines 6-9).

The spring element includes a conductive member for a number of reasons. For example, according to one embodiment of the present invention, such as that shown in Fig. 1, the spring element presses against the backside of the semiconductor. The conductive member may optionally be used to provide a backside biasing to the semiconductor. Also, where backside biasing is not required, the conductive member may provide, for example, improved heat dissipation in the test apparatus (Page 17, lines 6-11).

35 U.S.C. §112

Claims 50 and 51 were rejected under 35 U.S.C. §112, second paragraph as being indefinite. The Examiner argues that it is unclear what portion of the semiconductor comprises the "outer edge".

Claim 50 recites a semiconductor test apparatus having an attachment device comprising a spring element that engages a semiconductor about an outer edge of the semiconductor to press the semiconductor against an interconnect structure. The outer edge of the semiconductor has a commonly understood meaning. The semiconductor will have a peripheral surface forming an outer edge.

The semiconductor, such as semiconductor 12, to be tested is placed on the interconnect structure. To ensure good electrical contact between each bond pad on the semiconductor and the conductive traces on the interconnect structure, the spring element presses against the outer edge of the semiconductor. For example, a spring element such as the spring element illustrated in Fig. 9 may press on the outer edge of the backside of the semiconductor. Accordingly, the force applied to the semiconductor by the spring element is substantially uniform. The structure is explained in the specification at Page 15, lines 22-30.

The applicants assert that claim 50 is definite within the meaning of 35 U.S.C. §112, second paragraph, and thus request the Examiner withdraw the rejection. The applicants further request the Examiner withdraw the rejection of claim 51 as this claim depends from claim 50.

35 U.S.C. §102

Claims 29-31, 44, 47, 63-65 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6, 064, 217 issued May 16, 2000 to Smith (hereinafter "Smith"). According to the M.P.E.P. §706.02, in order to be anticipating under §102, the reference must teach every aspect of the claimed invention. See Carella v. Starlight Archery and Pro Line Co., 804 F.2d 135, 138, 231 U.S.P.Q. 644, 646 (Fed. Cir. 1986).

With regard to independent claims 29, 44, and 63, the Examiner has not met the burden of establishing a *prima facie* case of anticipation under 35 USC §102 because Smith fails to teach an attachment device arranged to press a semiconductor against an interconnect device, the attachment device comprising a spring element including a conductive member and an elastic member comprised of an elastomeric material.

Rather, as best shown in Fig. 6, the attachment device taught by Smith comprises a clamp plate 20A, a bolt 20B, and a clamp press 20C. The bolt 20B is threaded through the clamp plate 20A and is rotated to direct the clamp press upwards or downwards. The clamp press 20C rests directly on the backside of the semiconductor die 2 (col. 11, lines 24-32).

The only elastomeric material in the test apparatus taught by Smith is the elastomeric probes 4a. However, the elastomeric probes 4a are integral with the die carrier (interconnect device) and are used to form an electrical connection between the bond pads of the semiconductor and the bond carrier. For example, Smith recites that "[C]lamp 20, which is attached to the die carrier 4, will hold the die 2 in place such that the bond pads 2A of the die 2 maintain electrical continuity with the electrically conductive elastomeric probes 4a *which are permanently attached to the circuit pads 4b of the die carrier 4*" (emphasis added, col. 11, lines 19-25).

As recited in claim 29, for example, the attachment device includes an elastomeric spring element that presses the semiconductor against the attachment device. Further, the elastomeric material of the spring element need not couple electrical signals from the semiconductor to another device. Independent claims 44 and 63 recite similar language. In contrast, in Smith, the attachment device presses directly and rigidly against the semiconductor.

Accordingly, the applicants request the Examiner withdraw the rejection of claims 29, 44 and 63 under 35 USC §102. The applicants further request the Examiner withdraw the rejections of claims 30-31 as these claims depend from claim 29; claim 47 as this claim depends from claim 44; and claims 64 and 65 as these claims depend from claim 63.

35 U.S.C. §103

Claims 36-40 were rejected under 35 U.S.C. §103(a) as being unpatentable over Smith in view of an IEEE article "A Comparison on Metal-in-Elastomer Connectors: The Influence of Structure on Mechanical and Electrical Performance" published June 1991 by Rosen et al. (herein after Rosen).

According to the MPEP §706.02(j), to meet a threshold showing of *prima facie* obviousness, the prior art references must teach or suggest all of the claimed limitations. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The Examiner did not meet the burden of establishing a *prima facie* case of obviousness because Smith combined with Rosen fails to teach or suggest an attachment device arranged to press a semiconductor against an interconnect device, the attachment device comprising a spring element comprising a conductive member and an elastic member comprised of an elastomeric material as recited in the base independent claim 29.

Rosen teaches embedding metallic conductors oriented in the z-direction of an elastomeric substrate. By properly positioning the conductors with respect to the insulator (elastomeric material), an anisotropic conduction of electrical current is realized. It is clear that the structures described by Rosen are *electrical connectors* to

provide an *interconnect* for separable high-density media. Rosen does not suggest at all that such a construction would make a suitable spring element as claimed.

The structure taught by Rosen is an interconnect thus it is meant to couple electrical elements together using conductors running through its elastomer. Such a structure is not intended to be used as a spring element of an attachment device arranged to press a semiconductor against an interconnect structure.

Smith also fails to teach or suggest an attachment device arranged to press a semiconductor against an interconnect device, the attachment device comprising a spring element comprising a conductive member and an elastic member comprised of an elastomeric material. An analysis of Smith with respect to independent claim 29 is more fully set out above. Accordingly, the applicants request the Examiner withdraw the rejection of claims 36-40 under 35 USC §103.

The applicants thank the Examiner for the early indication of allowable subject matter. With respect to claims 45, 46, and 73, the applicants assert that the claims are not amended herein to place the claims in independent form because applicants believe these claims to be dependent upon allowable base claims.

Claims 44, 45, 50, 54, and 63 have been amended herein to replace the recitation of "modulus of elasticity" with the recitation of "force transfer characteristics". Support for the use of terminology "force transfer characteristics" can be found in the specification on page 13, lines 9-12. The reason for this change is to clarify that the claims teach a spring element that can be modified, such as by adding a plurality of holes, or by adding additional elastomeric material to the spring element for example, to change the amount of force (the force transfer characteristics) the attachment device applies to press the semiconductor against the interconnect structure.

For example, claim 44 recites a spring element having a first elastic member comprised of a first elastomeric material. The first elastomeric material has a modulus of elasticity and certain force transfer characteristics. Claim 44 also recites that there are a plurality of holes formed in the first elastomeric member. The holes in the first elastomeric material allow the elastomeric member to compress more easily. As a result of this, the overall force transfer characteristics of the elastomeric member having a plurality of holes formed therein is different from the force transfer characteristics of the elastomeric member without holes formed therein. Therefore, the reference to "first" force transfer characteristics is provided to illustrate that the force transfer characteristics of the elastomeric member are being changed.

CONCLUSION

For all of the above reasons, the applicants respectfully submit that claims 29-31, 36-40, 44-47, 50, 51, 54-56, 63-65, 68, 69 and 73 represent allowable subject matter. The Examiner is encouraged to contact the undersigned to resolve efficiently any formal matters or to discuss any aspects of the application or of this response. Otherwise, early notification of allowable subject matter is respectfully solicited.

Respectfully submitted,
KILLWORTH, GOTTMAN, HAGAN &
SCHAEFF, L.L.P.

By


Thomas E. Lees

46,867

One Dayton Centre
One South Main Street, Suite 500
Dayton, Ohio 45402-2023
Telephone: (937) 223-2050
Facsimile: (937) 223-0724